Exhibit R-2, PB 2010 Office of Secretary Of Defense RDT&E Budget Item Justification									DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)					R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	61.224	94.153	95.734						Continuing	Continuing
1: High Speed / Hypersonic Test	15.681	17.363	18.906						Continuing	Continuing
2: Spectrum Efficient Technology	1.177	6.349	6.210						Continuing	Continuing
3: Multi-Spectral Test	9.357	14.239	16.505						Continuing	Continuing
4: Non-Intrusive Instrumentation	7.451	6.519	4.846						Continuing	Continuing
5: Directed Energy Test	14.753	16.964	20.419						Continuing	Continuing
6: Netcentric Systems Test	8.807	12.254	12.477						Continuing	Continuing
7: Unmanned and Autonomous System Test	3.998	5.465	6.371						Continuing	Continuing
8: Common Range Integrated Instrumentation System	0.000	15.000	10.000						Continuing	Continuing
9: Multi-Level Security	0.000	0.000	0.000						Continuing	Continuing

A. Mission Description and Budget Item Justification

The Test and Evaluation /Science and Technology (T&E/S&T) program seeks out and develops test technologies to pace evolving weapons technology. The program is critical to ensuring that the Department of Defense (DoD) has the capability to adequately test the advanced systems that will be fielded in the future. To meet this objective, the T&E/S&T program:

- Exploits new technologies and processes to meet important Test and Evaluation (T&E) requirements.
- Expedites the transition of new technologies from the laboratory environment to the T&E community.
- Leverages commercial equipment, modeling and simulation, and networking innovations to support T&E.

Exhibit R-2, PB 2010 Office of Secretary Of Defense RDT&E Budget Item Justification	DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	**R-1 ITEM NOMENCLATURE** PE 0603941D8Z Test and Evaluation/Science and Technology

Additionally, the T&E/S&T program examines emerging T&E requirements derived from joint service initiatives to identify needed technology areas and develop a long-range roadmap for technology insertion. The program leverages and employs applicable 6.2 applied researches from the highly developed technology base in the DoD laboratories and test centers, other government agencies, industry, and academia to accelerate the development of new test capabilities. This PE also provides travel funds for T&E/S&T program oversight, special studies, analyses, and strategic planning related to test capabilities and infrastructure.

The T&E/S&T program is funded within the Advanced Technology Development Budget Activity because it develops and demonstrates high payoff technologies for current and future DoD test capabilities.

B. Program Change Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011
Previous President's Budget	62.344	94.672	96.358	
Current BES/President's Budget	61.224	94.153	95.734	
Total Adjustments	-1.120	-0.519	-0.624	
Congressional Program Reductions		-0.519		
Congressional Rescissions				
Total Congressional Increases				
Total Reprogrammings				
SBIR/STTR Transfer	-1.120			
Inflation Adjustments			-0.624	

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					PROJECT NUMBER 1	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
1: High Speed / Hypersonic Test	15.681	17.363	18.906						Continuing	Continuing

A. Mission Description and Budget Item Justification

DoD is developing air-breathing weapons, advanced aircraft and access to space platforms to operate in the high speed (Mach 3-5) and hypersonic speed (Mach 5 and above) regimes. High speed/hypersonic systems to be developed by DoD will require T&E capabilities in numerous areas ranging from ground testing [e.g. wind tunnels, sled tracks, installed-system test facilities, and modeling and simulation (including computational fluid dynamics)] to flight testing. At high and hypersonic speeds, flight testing will challenge existing ground instrumentation systems (e.g., tracking system slew rate limitations, telemetry dropouts due to ionization, etc.) and range safety decision making. High speed/hypersonic weapon systems will depend on several new technological thrusts in areas such as propulsion and engines, structures and materials, guidance and control, seekers and sensors, warheads and payloads, and weapons delivery techniques and end-game dynamics each of which requires supporting T&E capabilities to determine performance, effectiveness, suitability, survivability, and responsiveness to Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance systems. Service improvement and modernization programs are addressing some basic test facility upgrades using off-the-shelf technologies; however, T&E of high speed/hypersonic systems will require technologies as yet undeveloped or unavailable for T&E purposes. DoD must have adequate T&E capabilities in place in time to meet current development and, ultimately, acquisition program schedules. The purpose of the T&E/S&T High Speed/Hypersonic Test focus area is to address these T&E technology issues.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
High Speed/Hypersonic Test	15.681	17.363	18.906	
FY 2008 Accomplishments: - Continued efforts initiated in prior years. - Completed Pulsed Electron Beam Spectroscopy project to develop and demonstrate non-intrusive sensor technology for temperature and gas concentration measurements in the flow field of hypersonic ground test facilities. - Completed Test Media Effects project, incorporating the effects of vitiates into computational fluid dynamics codes to predict flame holding within hypersonic vehicle combustors used in hypersonic combustion engine tests.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 1

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
The effort advances the state-of-the-art in ground test instrumentation for characterization of test environments, and enables characterization of the hypersonic vehicle performance in a wind tunnel using vitiated air and prediction of vehicle flight performance. - Continued Arc Heater Aerothermal project to improve aerothermal test capabilities for ground test of ballistic reentry vehicles. - Continued Clean Air Heater Test Technology project to design and fabricate a high-pressure, elevated temperature air flow system. Continued Combustion Gas Analysis project to fabricate and ground test a non-intrusive laser spectroscopy diagnostic sensor suitable for in-flight T&E of hypersonic propulsion systems. - Continued High Pressure Arc Heater project to extend the operating regime for arc heater facilities to Mach 8-12 regimes. Efforts will provide true air operating conditions to support testing of thermal protection systems and hypersonic combustion systems. - Continued Hypersonic Engine-Facility Interaction project to resolve ground test issues related to vitiate effects at various test facilities using different combustion heater fuels. Efforts will provide an empirical understanding of the effects of vitiated air on hypersonic scramjet engines and support analysis of ground test performance at test facilities. - Continued Micro Fiber Optical Sensor project to develop advanced instrumentation for hypersonic flight test of hot structures; this effort will utilize micro heat transfer sensors for leading edges and pressure sensors for laminar-turbulent transition detection. - Continued Microelectromechanical System (MEMS) Shear Stress Sensor project, demonstrating sensing of bulk shear level and paving the way for flight demonstration. - Continued Modeling and Simulation (M&S) for Hypersonic T&E project to improve mode transition modeling, including capabilities to conduct numerical simulation of time-independent mode transition and simulation of ram to scram mode transition. - Continued Regenerative Storage Heater project to provide a technique to produce non-vitiated air for ground test of hypersonic propulsion systems in a true flight environment; efforts will center on finalizing pilot heater system design. - Continued Variable Mach Number Nozzle project to develop a high Mach number capability, including variable Mach numbers, for propulsion ground test.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 1

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continued Variable Mach Number Test Capability project to develop variable Mach 5-7 test capability using energy addition downstream of the plenum. Initiated and conducted new research efforts to address T&E technology challenges in this focus area. - Hypersonic Impulse Facility Analysis project to compare hypersonic propulsion data generated by impulse and short-duration facilities at Mach 5 and Mach 8 and to analyze related runtime and vitiation affects. - Magnetohydrodynamics Augmentation project to vary wind tunnel Mach number. - Parameter Identification Maneuvers project to enable more efficient and productive flight testing. Initiated Broad Agency Announcement (BAA) in FY 2008 to select efforts for FY 2009 award. *FY 2009 Plans:* Continue efforts initiated in prior years. - Complete Arc Heater Aerothermal project to improve aerothermal test capabilities for ground test of ballistic reentry vehicles. - Complete Combustion Gas Analysis project to fabricate and ground-test a non-intrusive laser spectroscopy diagnostic sensor suitable for in-flight T&E of hypersonic propulsion systems. - Complete High Pressure Arc Heater project to extend the operating regime for arc heater facilities to Mach 8-12 regimes. Efforts will provide true air operating conditions to support test of thermal protection and hypersonic combustion systems. - Complete MEMS Shear Stress Sensor project, finalizing fabrication of flight weight system. - Complete M&S for Hypersonic T&E project to develop enhanced M&S tools in support of integrated test article and facility effects modeling; these tools will enable detailed analysis of hypersonic system test prior to physical test in order to reduce risk and cost associated with ground test events. - Complete Micro Fiber Optical Sensor project to develop advanced instrumentation for hypersonic flight test of hot structures; this technology will utilize micro heat transfer sensors for leading edges and pressure sensors for laminar-turbulent transition detection. - Complete Variable Mach Number Nozzle project for propulsion ground test. - Complete Variable Mach Number Test Capability project, developing variable Mach 5-7 test capability using energy addition downstream of the plenum.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 1

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue Clean Air Heater project, developing a sub-scale resistive element clean air heater system. This technology will support development of a full-scale wind-tunnel heater system capable of providing continuous clean air flow for use in hypersonic aeropropulsion tests. - Continue Hypersonic Engine-Facility Interaction project to enable comparison between research and operational engines and between test facilities, and to predict the influence of vitiate species on overall system performance. - Continue Hypersonic Impulse Facility Analysis project to compare the hypersonic propulsion data generated by impulse and short-duration facilities at Mach 5 and Mach 8, and to analyze related runtime and vitiation affects. - Continue Magnetohydrodynamics Augmentation project to vary wind tunnel Mach number. - Continue Parameter Identification Maneuvers project to enable more efficient and productive flight testing. - Continue Regenerative Storage Heater project, developing a brick storage heater based on novel cored brick materials. Initiate new research efforts to address T&E technology challenges in this focus area. - Advanced Nozzle Throat Designs project to identify high temperature alloys and determine properties for high enthalpy nozzles. - Autonomous Flight Termination and Decision System project to develop this technology for hypersonic test vehicle application. - Clean Air Supply System project to design necessary components for future hypersonic propulsion facilities. - Hypersonic Test Fuel system project to develop a modular hypersonic fuel conditioning system for hypersonic test needs. - Hypersonic Nozzle Cooling project to design tools to extend Mach range and facility nozzle life. - In-Flight Thrust Measurement project to enable wavelength multiplexed, tunable diode laser spectroscopy measurement of scramjet thrust using velocity, density, and combustion species. - Mid-Pressure Arc Heater project to develop core enabling technologies for high enthalpy, long duration arc heater test.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 1

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Demonstrate and verify M&S and advanced flow diagnostics technologies developed by HSHT during the Revolutionary Approach to Time Critical Long Range Strike program Missile-in-a-Tunnel test at the NASA Glenn 10x10 supersonic wind tunnel. Initiate BAA in FY 2009 to select efforts for FY 2010 award. *FY 2010 Plans:* Continue efforts initiated in prior fiscal years. - Complete Hypersonic Nozzle Cooling project to design tools to extend Mach range and life of facility nozzles. - Complete development and analysis of power-efficient and spectrally-efficient CPM-OFDMA effort, refining the system model based upon performance simulation. - Complete dynamic spectrum access effort, integrating the QoS management scheme into a hybrid network software and conducting laboratory tests, field tests, and demonstrations. - Complete high-rate, high-speed FEC architectures for aeronautical telemetry effort, developing hardware to coherently and non-coherently demodulate/decode FEC waveforms. - Complete low-cost OFDM transceiver effort, integrating the 10W power amplifier module and the low-power AOFDM transceiver and testing the integrated unit. - Complete TCP/IP for aeronautical networks effort, porting and demonstrating the congestion control implementation. - Continue aeronautical network transport protocols effort, simulating and analyzing the protocol suite. - Continue dynamic software commutation/decommutation effort, implementing the software in an embedded system suitable for integration within a test article. - Continue iNET management and operations with policy controls effort, incorporating an enhanced set of policies for QoS, spectrum, network formation, security, and routing into the distributed policy-based network management system design. - Continue spectrum management system with channel modeling and improved coding techniques effort, building a system prototype and conducting an initial field test. Initiate BAA in FY 2010 to select efforts for FY 2011 award.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 1

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					PROJECT NUMBER 2	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
2: Spectrum Efficient Technology	1.177	6.349	6.210						Continuing	Continuing

A. Mission Description and Budget Item Justification

The Spectrum Efficient Technology (SET) focus area enables T&E of technologies for more efficient use of legacy telemetry bands and expansion into non-traditional areas of the radio frequency spectrum and the optical spectrum. The Test Resource Management Center realigned SET to perform risk reduction and advanced technology development for the Central Test and Evaluation Program (CTEIP) integrated Network Enhanced Telemetry (iNET) project. iNET is developing an architectural concept for a telemetry network system to address the needs of the T&E and training communities. However, as the iNET architecture was insufficiently defined in time to guide selection and funding of realigned SET projects, the focus area funded no new projects in FY 2008; SET has resumed the standard selection and funding process for execution of new projects in FY 2009.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Spectrum Efficient Technology	1.177	6.349	6.210	
FY 2008 Accomplishments: Continued efforts initiated in prior fiscal years. - Completed Broadband Telemetry Antenna project, including fabrication, integration, testing, and delivery of antennas 1 and 2. - Completed Aeronautical Network Telemetry project, coordinating layer-2 & layer-3 Quality of Service (QoS) approach, confirming transport layer interoperability, and concluding final architecture refinement. - Completed Medium Access Control project, finalizing high fidelity simulations. - Completed Improved Linear Power Amplifier project, reducing linear transmitter power supply, heat sink requirements, weight, size, and cost by 30 percent. - Completed Beamformer Antenna project with successful flight test of prototype antenna. - Continued Enhanced Forward Error Correction (EFEC) project, designing coherent and non-coherent decoders, and measuring coding gain and acquisition time through simulation to identify optimal EFEC code/decoder combinations. - Continued Space-Time Code project to develop a verified space-time code data encoding and processing technique and a prototype receiver designed to improve link reliability.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 2

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continued Spectrally Efficient, High Data Rate Telemetry project, to port and modify the Jet Propulsion Laboratory (JPL) Advanced Orthogonal Frequency Division Multiplexing (AOFDM) baseband processing firmware to carry out packet-based communications on an embedded PC/104 platform, and deliver a prototype transmitter/receiver pair. - Ended and closed out Radio Frequency (RF) MEMS Antenna project. - Ended and closed out Phased Array Antenna project. Initiated BAA in FY 2008 to select efforts for FY 2009 award. *FY 2009 Plans:* Continue efforts initiated in prior fiscal years. - Complete EFEC project, finalizing coherent and non-coherent decoders and delivering detailed design of decoders with a performance table identifying the optimal EFEC code/decoder combinations. - Complete Space-Time Code project, delivering a verified space-time code data encoding and processing technique and a prototype receiver designed to improve link reliability. - Complete Spectrally Efficient, High Data Rate Telemetry project, porting and modifying the JPL AOFDM baseband processing firmware to carry out packet-based communications on an embedded PC/104 platform, and deliver a prototype transmitter/receiver pair to Wallops Flight Facility. Initiate new research efforts to address T&E technology challenges in this focus area. - Aeronautical network transport protocols effort to build aeronautical transport, network, and routing protocols for the iNET Communication Link Standards and to verify the protocols through simulations and a fielded prototype. Efforts will include architectural design of the protocol suite. - Development and analysis of power-efficient and spectrally-efficient continuous-phase modulation orthogonal frequency division multiple access (CPM-OFDMA) effort to map a CPM waveform into an OFDM waveform in order to create a waveform that tolerates non-linear amplification during transmission such that a receiver can robustly receive the compressed waveform. Efforts include initial modulator/ demodulator system modeling, determination of system parameters, performance testing through simulation, and analysis of test results to determine key waveform advantages. - Dynamic software commutation/decommutation effort to optimize network performance by making real-time changes to test article telemetry content selection and sample rate and to demonstrate the optimization method in the field with a prototype network. Efforts will include development of				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 2

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
an optimized, software-based system that supports real-time changes to content and sample rate parameters. - Dynamic spectrum access effort to develop a network QoS management scheme using explicit control of both frequency and digital access slot assignments. - High-rate, high-speed forward error correction (FEC) architectures for aeronautical telemetry effort to apply FEC in telemetry by developing hardware to demodulate/decode FEC waveforms. - iNET management and operations with policy controls effort to develop a distributed policy-based network management system. - Low-cost OFDM transceiver effort to demonstrate the Tier 3 waveform by porting innovative AOFDM modulator and demodulator firmware to a flight-rated transceiver with a tunable RF transmit/receive module. - Multipath modeling and mitigation using multiple antennas to construct empirically validated multipath channel models for flight line and helicopter pad environments and to develop multipath mitigation techniques by using the multipath channel models. - Spectrum management system with channel modeling and improved coding techniques to develop a method of dynamically sharing spectrum across concurrent test activities by assessing instantaneous demand for network resources. - TCP/IP for aeronautical networks effort to develop a performance-enhancing-proxy (PEP) for the wired/ wireless interface that maximizes data throughput by minimizing the latency of individual packets. Efforts will include PEP development, congestion control implementation, and simulation. Initiate BAA in FY 2009 to select efforts for FY 2010 award. *FY 2010 Plans:* Continue efforts initiated in prior fiscal years. - Complete development and analysis of power-efficient and spectrally-efficient CPM-OFDMA effort, refining the system model based upon performance simulation. - Complete dynamic spectrum access effort, integrating the QoS management scheme into a hybrid network software and conducting laboratory tests, field tests, and demonstrations. - Complete high-rate, high-speed FEC architectures for aeronautical telemetry effort, developing hardware to coherently and non-coherently demodulate/decode FEC waveforms.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 2

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Complete low-cost OFDM transceiver effort, integrating the 10W power amplifier module and the low-power AOFDM transceiver and testing the integrated unit. - Complete TCP/IP for aeronautical networks effort, porting and demonstrating the congestion control implementation. - Continue aeronautical network transport protocols effort, simulating and analyzing the protocol suite. - Continue dynamic software commutation/decommutation effort, implementing the software in an embedded system suitable for integration within a test article. - Continue iNET management and operations with policy controls effort, incorporating an enhanced set of policies for QoS, spectrum, network formation, security, and routing into the distributed policy-based network management system design. - Continue spectrum management system with channel modeling and improved coding techniques effort, building a system prototype and conducting an initial field test. Initiate BAA in FY 2010 to select efforts for FY 2011 award.				

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					PROJECT NUMBER 3	
COST ($ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
3: Multi-Spectral Test	9.357	14.239	16.505						Continuing	Continuing

A. Mission Description and Budget Item Justification

The Multi-Spectral Test (MST) focus area develops technologies to test multi-spectral and hyperspectral sensors, seekers, and detectors for weapon systems and intelligence, surveillance, and reconnaissance systems. T&E of new MS and HS sensors to be used in these future weapon systems will require new T&E technologies. Current methods for testing MS and HS sensors rely heavily on expensive field test programs. While these field tests provide realistic data for sensor testing, they leave several critical gaps. For example, test conditions are not repeatable because environments observed one day will be different the next. Imagery can be collected and stored to partially mitigate this deficiency, but the process is expensive and cannot cover the full spectrum of environments required for complete test article evaluation and performance analysis. The T&E community needs the ability to test these advanced seekers and sensors in a repeatable, objective fashion before and after they are integrated into warfighting systems. Without these new T&E technologies, DoD will be unable to perform adequate test and evaluation of the MS and HS weapon systems of the future.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Multi-Spectral Test	9.357	14.239	16.505	
FY 2008 Accomplishments: Continued efforts initiated in prior fiscal years. - Continued MicroPlamsa Emitter project, generating a new method of supplying large voltages to a plasma display, completing Phase I, and beginning Phase II. - Continued multi-spectral and hyperspectral Polarized Scene Projector project, including assembly, characterization, and demonstration of the achromatic phase spatial light modulators; development of software for a brassboard projector; and design, assembly, and characterization of projection optics engine. - Continued Multi-Spectral Passive long-wave infrared Polarization Signature Model project to develop a dynamic, visible/short-wave infrared (VIS/SWIR) and polarization-capable MS scene and signature prediction model for realistic testing of emerging sensors, seekers, algorithms, and signature management treatments. Additional efforts included finalization of software requirements, characterization of Bidirectional Reflectance Distribution Function (BRDF), and approach definition for integration.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 3

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continued Next Generation Read-in Integrated Circuits for IR Scene Projection project, testing the NOVA-013 chip and drive electronics and designing the NOVA-014 (512x512) chip. - Continued Sub-Array Light Emitting Diode project, including full-scale fabrication of the ultraviolet array integrated with reflective optics. - Continued Super-lattice Light-Emitting Diode (SLED) project. Successfully tested the design developed for Mid-Wave Infrared (MWIR) SLED and continued fabrication of a Long-Wave Infrared (LWIR) array for testing. Initiated new research efforts to address T&E technology challenges in this focus area. - Cell-based Hyperspectral Atmospheric Radiation Model project to develop a flexible processing architecture to exploit the power of high performance computers and graphics processing unit. - Hyperspectral Imaging Projector project to develop a high output, broadband, MWIR source to control, measure, and correct stray light in the projector and in the reference instrument used to characterize the projected scenes. - Hyperspectral Test Suite project to incorporate seamless, continuous and synchronized MWIR coverage into the existing Hyperspectral Testbed. - Very Near Infrared (NIR)/SWIR and Passive LWIR Polarization Signature Model project to model a 5km x 5km area containing at least 20 vehicles and detailed vegetation and terrain features in the VIS, NIR, and SWIR spectra. - Initiated fiber-optic infrared countermeasures (IRCM) test and evaluation technology designing integration optics for testing infrared countermeasures and missile warning systems. *FY 2009 Plans:* Continue efforts initiated in prior fiscal years. - Complete Sub-Array Light Emitting Diode project with final demonstration. - Continue Cell-based Hyperspectral Atmospheric Radiation Model project and Multi-Spectral Passive long-wave infrared Polarization Signature Model project. Developers will work collaborate to use a breadboard of the former as front end for brassboard testing of the latter. - Continue Hyperspectral Imaging Projector project, developing, designing, and characterizing fibers and an amplified spontaneous emission source.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 3

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue Hyperspectral Test Suite project, fabricating major subsystems including diffuser and mask, Offner spectrograph, collimator, and characterization unit. - Continue Micro-Plasma Emitter project, implementing new design plan based on program management review/decision. - Continue Multi-Spectral and Hyperspectral Polarized Scene Projector project, generating software for integration and demonstration of a brassboard projector. - Continue Next Generation Read-in Integrated Circuits for IR Scene Projection project, fabricating 512x512 arrays for both photonic crystals and light emitting diodes, and evaluating options for a 1k x 1k array chip carrier. - Continue Superlattice Light Emitting Diodes project, testing and delivering a 512x512 MWIR/LWIR SLED array, the delivering scalability design for arrays 1024x1024 or larger, and submitting the final report. - Continue Initiated fiber-optic infrared countermeasures (IRCM) test and evaluation technology (FITT) designing integration optics for testing infrared countermeasures and missile warning systems. Initiate new research efforts to address T&E technology challenges in this focus area. - Missile Airframe Simulation Testbed project to create a Surface-to-Air Missile surrogate and a vehicle to carry instrumentation for observation of ground systems. - The Multi-wavelength Infrared Simulation Laser project and the Advanced Quantum Cascade Laser Infrared Simulator project are competing efforts to generate a continuous quantum laser with enough power to stimulate a missile warning system at a distance. - Sky Imaging Mapping System project to generate true sky lighting, which affects targeting and scene generation. *FY 2010 Plans:* Continue efforts initiated in prior fiscal years. - Complete Micro-Plasma Emitter project to provide the capability to accurately represent high temperature and flexible spectral emitters for representation of threat weapon signatures in hardware-in-the-loop T&E. - Complete Multi-Spectral and Hyperspectral Polarized Scene Projector project to enable precise control of parameters required to test and evaluate polarized sensors.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 3

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Complete Multi-Spectral Passive long-wave infrared Polarization Signature Model project to provide capability for a high spatial/spectral resolution, radiometric, predictive VIS/SWIR background model. This technology will incorporate validated threat signatures for sensor/seeker T&E. - Complete Next Generation Read-in Integrated Circuits for IR Scene Projection project with a 1k x 1k array design. - Continue Hyperspectral Imaging Projector project with prototype assembly and testing. - Continue Hyperspectral Test Suite project with subsystems testing and prototype integration and assembly. - Continue Missile Airframe Simulation Testbed project to create a Surface-to-Air Missile surrogate and a vehicle to carry instrumentation for observation of ground systems. - Continue Multi-Wavelength Infrared Simulation Laser project and the Advanced Quantum Cascade Laser Infrared Simulator project (competing efforts) to generate a continuous quantum laser with enough power to stimulate a missile warning system at a distance. - Continue Sky Imaging Mapping System project to generate true sky lighting, which affects targeting and scene generation. - Continue FITT project, designing integration optics for infrared countermeasures and missile warning systems, developing a 64x64 fiber array, and developing the fiber array coating. Initiate new research efforts to address T&E technology challenges in this focus area. - Hyperspectral NIR/SWIR projector effort to complete the entire spectrum of interest from NIR to LWIR when combined with the Hyperspectral Testbed and Hyperspectral Test Suite projects. - Improvised explosive device signature T&E effort to develop a suite of tests designed for systems that detect improvised explosive devices. - Multi-Spectral/Hyperspectral data fusion T&E effort to enable the combination of all scene generation techniques, including all bandwidths from NIR to LWIR, into one highly detailed, information rich battle scene. - Multi-Spectral/Hyperspectral field characterization system effort for further characterization and classification of realistic battle scene imagery. - Multi-Spectral/Hyperspectral ground targets effort to allow MST to generate ground targets and to alleviate the use of software license costs and associated issues when dealing with third party target generation databases.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 3

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Initiate a BAA in FY 2010 to select efforts for FY 2011 award.				

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					PROJECT NUMBER 4	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
4: Non-Intrusive Instrumentation	7.451	6.519	4.846						Continuing	Continuing

A. Mission Description and Budget Item Justification

Instrumentation requirements for systems-under-test, hardware-in-the-loop testing, and training are increasing exponentially for new weapon systems. Onboard or personnel-borne instrumentation and equipment are required for sensing and collecting critical performance data; determining accurate time, space, position, and attitude information; interfacing with command and control data links; monitoring and reporting system-wide communications; reporting human operator performance; and storing and transmitting data. These requirements drive the need for enabling technologies for miniaturized, non-intrusive instrumentation suites with increased survivability in harsh environments, which the T&E/S&T Non-Intrusive Instrumentation (NII) focus area addresses. Minimal space is available for adding instrumentation to new weapon systems subsequent to their development; moreover, additional weight and power draw can adversely affect weapon system signature and performance. Instrumentation for humans-in-the-loop, such as a dismounted soldier, should neither adversely affect soldier performance nor create operational burden. New technologies can be exploited to integrate small non-intrusive instrumentation into new platforms during design and development, and, in some cases, into existing platforms. This class of instrumentation can provide the required data for T&E, training, and logistics throughout system lifecycle, and provide the ability to collect critical system performance data during combat missions.

The use of non-intrusive instrumentation for T&E, training, and logistics has the potential to significantly reduce the total ownership cost of new weapon systems while enhancing force readiness. Accordingly, the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01D states that acquisition programs should include embedded instrumentation as part of system trade-off studies and design analyses.

This focus area was established to address the T&E challenges discussed above; however, it has been determined that requirements and transition partners must be better defined and understood. Accordingly, this focus area did not initiate any FY 2008 new start projects, but is developing a new NII T&E technology roadmap to determine the best path forward. Ongoing projects will continue to completion. NII will fund new projects in FY 2010 based upon the roadmap effort.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Non-Intrusive Instrumentation	7.451	6.519	4.846	
FY 2008 Accomplishments: Initiated new NII Roadmap development effort to address T&E technology challenges in this focus area. Continued efforts initiated in prior fiscal years. - Completed Advanced Munitions Flight Test Instrumentation project to develop, fabricate, and flight test a MEMS-based instrumentation module; delivered high-g and low-g accelerometers and a final report.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 4

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Completed Digital Communications Test Data Bus project to develop and demonstrate a prototype miniaturized, self-calibrating embedded instrumentation system consisting of smart sensors, a subsystem controller, and a processor. The instrumentation system is capable of operating on missile system power in the operational environment and will be able to support continuous life cycle T&E. - Completed Harsh Environment D-Fiber Sensors project to enhance D-Fiber sensors by improving spectral response, reducing fiber brittleness, and improving sensor packaging. Fiber sensor integrated monitoring was enhanced by developing high speed monitoring and a wavelength sweeping source, which are survivable in extreme environments. - Completed Holographic Memory Cube Upgrade project to harden and optimize performance for terabyte data storage and retrieval. - Completed final phase of the MEMS Fiber Optic Sensors project to develop, test, and deliver advanced integrated pressure, temperature, and shear stress sensors coupled onto optical fibers for non-intrusive T&E of aerospace systems. - Continued High Speed and Temperature Diagnostics project to develop a series of probes to withstand continuous exposure to hypersonic test environments. This effort is developing an optical species probe, total pressure probe, total temperature probe, and Mach/flow angularity probe. The probes will support both ground and flight test of hypersonic vehicles. - Continued MEMS Optical Pressure Sensors project to develop an integrated optical pressure sensor package for on-blade acoustic measurement of pressure patterns. - Continued Multi-Species Gas Sensor Arrays to develop a high temperature, multi-chemical sensor array for analysis of critical constituents in turbine engine exhaust products. - Continued Open Modular Embedded Instrumentation Architecture project to design and develop an open, modular, scalable, embedded system architecture. The architecture has been demonstrated in tests of the Air Force Multi-Megawatt Electric Power System being developed for directed energy weapons applications; a final systems of systems demonstration is planned. - Continued Self Powered Chip project to design a power mixer-supply system integrated circuit, sensor system integrated circuit, and fuel cell-lithium ion brassboard. Efforts continue to test, evaluate, and optimize wireless telemetry and common, off-the-shelf sensor technologies. - Continued Ultra High Dynamics GPS project to develop GPS receivers with high dynamic, multi-frequency, anti-jam capability to provide TSPI in existing GPS-denied environments.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 4

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continued Wide Band Location Positioning System project to develop acquisition waveform and algorithms to test acquisition and tracking software and to design and test receiver and transmitter reference frequency. Efforts will provide TSPI in GPS-denied environments such as urban areas. Initiated new research efforts to address T&E technology challenges in this focus area. - Joint Advanced Missile Instrumentation risk reduction project to develop technical solutions for multi-path rejection. - Triply Redundant Integrated Navigation and Asset Visibility System project for TSPI on personnel in GPS-denied test environments. *FY 2009 Plans:* Continue efforts initiated in prior fiscal years. - Complete NII Roadmap effort to develop T&E use cases for identifying and refining technology requirements, potentially for power, data transformation, advanced sensors, and GPS-denied TSPI capabilities. This effort will support the FY 2009 Broad Agency Announcement process for FY 2010 new start selections. - Complete High Speed and Temperature Diagnostics project to develop and demonstrate a series of probes that can withstand continuous exposure to hypersonic test environments. Efforts will focus on completion of fabrication, testing and verification, and analysis of the total temperature probe. - Complete Joint Advanced Missile Instrumentation risk reduction project to develop technical solutions for multi-path rejection. - Complete Multi-Species Gas Sensor Arrays project to develop a high temperature, multi-chemical sensor array for analysis of critical constituents in turbine engine exhaust products. Efforts will focus on system operation demonstrations with a pathfinder test and several additional engine tests. - Complete Open Modular Embedded Instrumentation Architecture project to design and develop an open, modular, scalable, embedded system architecture. Efforts will focus on embedded middleware demonstration development. - Complete Self Powered Chip project to design a power mixer-supply system integrated circuit, sensor system integrated circuit, and fuel cell-lithium ion brassboard. Efforts will focus on subsystems verification, integrated circuit design and testing of the final prototype in a realistic environment.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 4

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Complete Ultra High Dynamics GPS project to develop GPS receivers with high dynamic, multi-frequency, and anti-jam capability to provide TSPI in GPS-denied environments. Efforts will focus on algorithm development and integration for the GPS L2 frequency (i.e., 1227.60 MHz), ground segment development, and testing. - Complete Wide Band Location Positioning System project to develop acquisition waveform and algorithms to test acquisition and tracking software and to design and test receiver and transmitter reference frequency. Efforts will focus on fabrication and verification testing of transmitters and receivers; testing in an urban environment; and conducting a military demonstration at Aberdeen Test Center. - Continue Triply Redundant Integrated Navigation and Asset Visibility System project for personnel/ asset location by integrating three components to provide highly accurate and reliable navigation in GPS-denied or degraded testing environments. Initiate BAA in FY 2009 to select efforts for FY 2010 award *FY 2010 Plans:* Continue efforts initiated in prior fiscal years. - Complete Triply Redundant Integrated Navigation and Asset Visibility System project for personnel/ asset location by integrating three components to provide highly accurate and reliable navigation in GPS-denied or degraded testing environments. Efforts will focus on integrating the Theater Positioning System, GPS, and an inertial navigation system. Initiate new efforts for award based on the NII Roadmap effort and BAA process: - Develop advanced micro-power sources to power non-intrusive test instrumentation components via advanced chemistry cells and batteries, energy harvesting devices, active power generators, charging devices, and/or load management devices. - Develop advanced sensor transducers to measure high-temperature, electric field strength, and/or magnetic field strength. - Develop alternative wireless data transport technologies (e.g., free space optical transmission, power bus transmission, transmission through conductive components, etc.). - Develop data transformation software to support virtual/synthetic instrumentation, adaptive computing for self-configuration, and self-calibration of instrumentation.				

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APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 4

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Develop leading edge electronic component miniaturization technologies (e.g., Application Specific Integrated Circuits and Field Programmable Gate Arrays) for advanced sensor electronics. - Develop instrumentation attachment technologies that are reliable in extreme temperatures and high dynamic environments. - Develop multi-modal transducers capable of measuring two or more phenomena simultaneously (e.g., temperature and pressure) at the same point. - Develop small volume data storage technologies capable of withstanding high shock. - Develop technologies to non-intrusively tap into an optical data bus without injecting optical noise or modifying or corrupting data carried on the bus. - Develop technologies to protect sensor electronics under environmental conditions significantly exceeding MIL-SPEC ranges. - Develop TSPI technologies to support dismounted soldiers in GPS-denied environments such as urban, underground, and dense vegetation.				

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					PROJECT NUMBER 5	
COST ($ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
5: Directed Energy Test	14.753	16.964	20.419						Continuing	Continuing

A. Mission Description and Budget Item Justification

Directed Energy (DE) test technologies are rapidly transitioning into acquisition programs and Advanced Concept Technology Demonstrations. These weapon technologies, primarily consisting of High Energy Lasers (HEL) and High Power Microwaves (HPM), are outpacing their supporting test technologies. Advancements in HEL and HPM have created a new class of weapon systems in which energy is placed on a target instantaneously; traditional test techniques for evaluating conventional munitions (with flight times ranging from seconds to minutes) are not applicable to DE systems T&E. As a result, new technology solutions are needed to ensure that adequate developmental, live fire, and operational test capabilities are available when DE acquisition programs are ready to test.

DE system and component testing requires two principal assessments: how well the weapon is performing, and the specific interaction of energy and target. The current ability to assess DE systems performance and interactions is based on effects testing, i.e., determining if and when a target was destroyed. Current capabilities do not provide the detailed test data required to understand DE system performance. Military utility of these weapons will be dependent upon the knowledge acquired through T&E to know how much to trust the technologies under development and how best to use them. The T&E/S&T Directed Energy Test focus area is developing the necessary technologies to quantitatively assess HEL and HPM performance and target interaction to support thorough testing of DE systems.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Directed Energy Test	14.753	16.964	20.419	
FY 2008 Accomplishments: Continued efforts initiated in prior fiscal years. - Completed Probe-based Irradiance Profiler project to develop a prototype system using a probe and beam camera to determine irradiance on an HEL target. Phase I demonstration effort did not meet accuracy and long range HEL test requirements. - Completed Reflectance and Data Fusion Model project to develop and demonstrate improved bidirectional reflection distribution function models to predict laser irradiance based on reflected energy measurements from various target material compositions. The effort developed a dynamic data fusion model that supports projection of two-dimensional HEL imagery onto three-dimensional target representations, allowing more detailed analysis of HEL-target interaction during T&E. - Continued Bi-static Optical Imaging Sensor project to design and fabricate a prototype ground-based HEL diagnostics sensor, and to install and characterize the prototype sensor.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 5

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continued Compact Three-Axis Sensor project to develop a compact, E-O sensor that detects three-axis electric field measurements during HPM irradiation. - Continued Dielectric Antenna Electro-Optical Sensor project to design and fabricate a prototype device consisting of a dielectric resonance antenna and electro-optical (E-O) resonator. - Continued Holographic Target Board project to design, fabricate, and test an HEL target board using photo-thermo-refractive glass to measure HEL irradiance of an incident laser beam. - Continued Laser Protected Antenna project to develop shielding techniques to protect flight termination system antenna from errant HEL irradiation. - Continued Magneto-Optical Field Sensor project to develop fiber-coupled optical sensors using the Faraday effect to non-intrusively capture magnetic fields during HPM irradiation. - Continued Multiple Wave Temperature Sensor project to design a multi-band camera system for target surface temperature measurement. - Continued Quantum Well Infrared Photodetector (QWIP) project to test an integrated QWIP, Near Infrared (NIR) Focal Plane Array, and Computed Tomographic Imaging Spectrometer (CTIS). The prototype camera system will be demonstrated in both lab and field environments. The QWIP/NIR/CTIS camera system will allow off-board analysis of HEL beam interaction with a target to characterize laser weapon performance. - Continued Scanning Target Board project to develop an HPM target board that uses an array of compact, multi-layered patch antennas to map the HPM source power spectrum. - Continued T&E Adaptive Optics System project to integrate and test an adaptive optics system in support of remote measurement of HEL temperature with high spatial and temporal accuracy. The adaptive optics system will be assembled and integrated into the Advanced Pointer Tracker at the HEL System Test Facility and demonstrated in a relevant environment. - Continued Temperature & Irradiance Sensor Matrix project to develop a matrix of conformal, onboard, photoconductive detectors to determine target irradiance and temperature profiles. Initiated new research efforts to address T&E technology challenges in this focus area. - Advanced Polymer Optical Source project to develop non-intrusive, large dynamic range, high bandwidth sensor to measure incident HPM magnetic field amplitude, internal cavity fields, and circuit board currents.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 5

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Atmospheric Transmission Measurement project to develop stationary, ground-based measurement of slant path transmission and optical turbulence for ranges of approximately 10km and at arbitrary slant paths. - Dual Oscillator Microwave Generation project to extend center frequency of spark gap oscillators from 500MHz to 2.5GHz, providing a test source for improved wide band HPM susceptibility testing. - Heat Flux Sensor Array project to integrate a low-cost, high-resolution temperature sensor with an Inverse Heat Conduction model in an instrument that can determine heat placed on a target by an HEL system. - Inversion-derived Resistive Temperature Sensor project to determine laser energy deposition onto a composite target. - Microwave Rotary Attenuator project to develop automated mechanism for variable power in an HPM narrowband source system. - Spectrographic Magnetic Field Sensor project to develop a non-intrusive point measurement of magnetic fields inside a component or system being exposed to HPM fields. - Temperature Irradiance and Extraction Measurement project to develop an “inverse problem” retrieval solution under HEL engagement based on in-band and out-of-band radiance imagery. - Cine Radiography Imagery Measurement project to develop a compact, flash X-ray source for testing of HPM explosives generators for HPM munitions. Initiated a BAA in FY 2008 to select efforts for FY 2009 award. *FY 2009 Plans:* Continue efforts initiated in prior years. - Complete Bi-static Optical Imaging Sensor project to develop, fabricate, and demonstrate a brass board hyper-spectral imager by utilizing a fiber-based field sensor. Develop the technology to use a bi-static hyper-spectral imager to remotely characterize multiple HEL beam wavelengths and power level signatures to support HEL test events. - Complete T&E Adaptive Optics System project to integrate and test an adaptive optics system in support of remote measurement of HEL temperature with high spatial and temporal accuracy. Integrated the adaptive optics system into the Advanced Pointer Tracker at the HEL System Test Facility.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 5

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Complete Quantum Well Infrared Photodetector (QWIP) project to test an integrated QWIP, Near Infrared (NIR) Focal Plane Array, and Computed Tomographic Imaging Spectrometer (CTIS). Demonstrate the prototype camera system in both lab and field environments. The QWIP/NIR/CTIS camera system will allow off-board analysis of HEL beam interaction with a target to characterize the laser weapon performance. - Complete Dielectric Antenna E-O Sensor project to fabricate and test a dielectric antenna with an embedded E-O crystal to measure changes in the electric field during an HPM engagement by allowing non-intrusive measurement of HPM environments with minimal impact on the fields measured. - Complete Holographic Target Board project to design, fabricate, and test large scale holographic HEL target boards using photo-thermo-refractive glass to measure HEL irradiance of the an incident laser beam. - Complete Multiple Wave Temperature Sensor project to integrate multi-band focal plane array, electronics, and operating software, and to characterize the multiple wave temperature sensor performance. - Complete Compact Three-Axis Sensor project to develop a sensor that measures short, pulsed HPM fields in real-time. Efforts will include design and integrate ultra-wideband capable, fast rise-time, high sensitivity, compact sensors for minimal perturbation of the measured field and three-axis polarizations. Test prototype sensor in a relevant environment. - Complete Laser Protected Antenna project to develop laser-hard shielding that does not interfere with antenna performance during HEL testing. Assess flight termination system antenna and component vulnerability in relation to laser irradiation and thermal damage, conduct design trades for protection concepts, and conduct radio frequency (RF) verification tests. - Continue Magneto-Optical Field Sensor project to apply the Faraday Effect at microwave bandwidths at remote locations from light source & detector to measure magnetic fields as well as use the electro-optical effect to measure electric field in order to better understand HPM. Test in a relevant environment. - Continue Scanning Target Board project to develop a system with sufficient resolution to derive energy distribution for direct measurement of primary beam shape of HPM systems and sources in complex environments.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 5

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue Temperature & Irradiance Sensor Matrix project to develop conformal, externally-mounted micro-sensors to resolve location and intensity of airborne HEL laser spots with minimal aerodynamic & thermal signature effects. - Continue Atmospheric Transmission Measurement project to develop stationary, ground-based measurement of slant path transmission and optical turbulence for ranges of ~ 10km and at arbitrary slant paths. - Continue Heat Flux Sensor Array project to integrate low-cost, high-resolution temperature sensor with an Inverse Heat Conduction model in an instrument that can be used determine heat put on target by an HEL system. - Continue Inversion-derived Resistive Temperature Sensor project to determine laser energy deposition onto a composite target. - Continue Temperature Irradiance and Extraction Measurement project to develop “inverse problem” retrieval solution under HEL engagement based on in-band and out-of-band radiance imagery. - Continue Microwave Rotary Attenuator project to develop automated mechanism for variable power in a High Power Microwave narrowband source system. - Continue Spectrographic Magnetic Field Sensor project to develop a non-intrusive point measurement of magnetic fields inside a component or system being exposed to HPM fields. - Continue Cine Radiography of Explosive HPM Munitions project to develop a compact flash X-ray source for development and testing of explosives driven HPM generators. - Continue Advanced Polymer Optical Source project to develop non-intrusive, large dynamic range and high bandwidth sensor to measure incident HPM magnetic field amplitude, internal cavity fields and circuit board currents. - Continue Dual Oscillator Microwave Generation project to extend center frequency of spark gap oscillators up from 500MHz to 2.5GHz, providing a test source for improved wide band High Power Microwave susceptibility testing. - Continue Atmospheric Transmission Measurement project to develop stationary, ground-based measurement of slant path transmission and optical turbulence for ranges of ~ 10km and at arbitrary slant paths.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 5

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue Heat Flux Sensor Array project to integrate low-cost, high-resolution temperature sensor with an Inverse Heat Conduction model in an instrument that can be used determine heat put on target by an HEL system. - Continue Inversion-derived Resistive Temperature Sensor project to determine laser energy deposition onto a composite target. - Continue Temperature Irradiance and Extraction Measurement project to develop “inverse problem” retrieval solution under HEL engagement based on in-band and out-of-band radiance imagery. - Continue Microwave Rotary Attenuator project to develop automated mechanism for variable power in a High Power Microwave narrowband source system. - Continue Spectrographic Magnetic Field Sensor project to develop a non-intrusive point measurement of magnetic fields inside a component or system being exposed to HPM fields. - Continue Cine Radiography Imagery Measurement project to develop a compact flash X-ray source for testing of High Power Microwave explosives generators for HPM munitions. - Continue Advanced Polymer Optical Source project to develop non-intrusive, large dynamic range and high bandwidth sensor to measure incident HPM magnetic field amplitude, internal cavity fields and circuit board currents. - Continue Dual Oscillator Microwave Generation project to extend center frequency of spark gap oscillators up from 500MHz to 2.5GHz, providing a test source for improved wide band High Power Microwave susceptibility testing. Initiate new research efforts to address T&E technology challenges in this focus area. - Integrated Electro-Magneto-optic Sensor project to develop a compact, non-intrusive sensor that will measure both Electric Field and Magnetic Field for a system under test under High Power Microwave Irradiation - Skin Heating and Electric Field sensors for in-situ measurement of electric field and skin temperature for use on human targets involved in operational testing of W-band microwave systems testing - Terahertz Imaging Profiler Array project to develop a high spatial resolution imaging system capable of characterizing and testing Terahertz systems. - Precision Radiometric Surface Temperature Measurement project to develop a non-contact surface temperature measurement capability for a system under irradiation from an HEL.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 5

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Surface Temperature Estimation Tool project to develop temperature estimation software that extract surface temperature of a system under HEL Irradiation without a priori knowledge of surface emissivity. - Beam Irradiance on Target project to develop an HEL Target Board with high spatial and temporal resolution - Irradiance Imaging System project to develop a remote HEL beam irradiance measurement capability that can measure irradiance at threat irradiance levels. Initiate a BAA in FY 2009 to select efforts for FY 2010 award. *FY 2010 Plans:* Continue efforts initiated in prior fiscal years. - Complete Magneto-Optical Field Sensor project to apply the Faraday Effect at microwave bandwidths at remote locations from light source & detector to measure magnetic fields as well as use the electro-optical effect to measure electric field in order to better understand HPM. Test in a relevant environment. - Complete Temperature & Irradiance Sensor Matrix project to develop conformal, externally-mounted micro-sensors to resolve location and intensity of airborne HEL laser spots with minimal aerodynamic & thermal signature effects. - Complete Heat Flux Sensor Array project to integrate low-cost, high-resolution temperature sensor with an Inverse Heat Conduction model in an instrument that can be used determine heat put on target by an HEL system. - Continue Scanning Target Board project to develop a system with sufficient resolution to derive energy distribution for direct measurement of primary beam shape of HPM systems and sources in complex environments. - Continue Atmospheric Transmission Measurement project to develop stationary, ground-based measurement of slant path transmission and optical turbulence for ranges of ~ 10km and at arbitrary slant paths. - Continue Inversion-derived Resistive Temperature Sensor project to determine laser energy deposition onto a composite target. - Continue Temperature Irradiance and Extraction Measurement project to develop “inverse problem” retrieval solution under HEL engagement based on in-band and out-of-band radiance imagery.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 5

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue Microwave Rotary Attenuator project to develop automated mechanism for variable power in a High Power Microwave narrowband source system. - Continue Spectrographic Magnetic Field Sensor project to develop a non-intrusive point measurement of magnetic fields inside a component or system being exposed to HPM fields. - Continue Cine Radiography of Explosive HPM Munitions project to develop a compact flash X-ray source for development and testing of explosives driven HPM generators. - Continue Advanced Polymer Optical Source project to develop non-intrusive, large dynamic range and high bandwidth sensor to measure incident HPM magnetic field amplitude, internal cavity fields and circuit board currents. - Continue Dual Oscillator Microwave Generation project to extend center frequency of spark gap oscillators up from 500MHz to 2.5GHz, providing a test source for improved wide band High Power Microwave susceptibility testing. - Continue Atmospheric Transmission Measurement project to develop stationary, ground-based measurement of slant path transmission and optical turbulence for ranges of ~ 10km and at arbitrary slant paths. - Continue Heat Flux Sensor Array project to integrate low-cost, high-resolution temperature sensor with an Inverse Heat Conduction model in an instrument that can be used determine heat put on target by an HEL system. - Continue Inversion-derived Resistive Temperature Sensor project to determine laser energy deposition onto a composite target. - Continue Temperature Irradiance and Extraction Measurement project to develop “inverse problem” retrieval solution under HEL engagement based on in-band and out-of-band radiance imagery. - Continue Microwave Rotary Attenuator project to develop automated mechanism for variable power in a High Power Microwave narrowband source system. - Continue Spectrographic Magnetic Field Sensor project to develop a non-intrusive point measurement of magnetic fields inside a component or system being exposed to HPM fields. - Continue Cine Radiography Imagery Measurement project to develop a compact flash X-ray source for testing of High Power Microwave explosives generators for HPM munitions.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 5

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue Advanced Polymer Optical Source project to develop non-intrusive, large dynamic range and high bandwidth sensor to measure incident HPM magnetic field amplitude, internal cavity fields and circuit board currents. - Continue Dual Oscillator Microwave Generation project to extend center frequency of spark gap oscillators up from 500MHz to 2.5GHz, providing a test source for improved wide band High Power Microwave susceptibility testing. - Continue Integrated Electro-Magneto-optic Sensor project to develop a compact, non-intrusive sensor that will measure both Electric Field and Magnetic Field for a system under test under High Power Microwave Irradiation - Continue Skin Heating and Electric Field sensors for in-situ measurement of electric field and skin temperature for use on human targets involved in operational testing of W-band microwave systems testing - Continue Terahertz Imaging Profiler Array project to develop a high spatial resolution imaging system capable of characterizing and testing Terahertz systems. - Continue Precision Radiometric Surface Temperature Measurement project to develop a non-contact surface temperature measurement capability for a system under irradiation from an HEL. - Continue Surface Temperature Estimation Tool project to develop temperature estimation software that extract surface temperature of a system under HEL Irradiation without a priori knowledge of surface emissivity. - Continue Beam Irradiance on Target project to develop an HEL Target Board with high spatial and temporal resolution - Continue Irradiance Imaging System project to develop a remote HEL beam irradiance measurement capability that can measure irradiance at threat irradiance levels. Initiate new projects selected in FY2010 BAA process. Initiate a BAA in FY 2010 to select efforts for FY 2011 award.				

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 5

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					PROJECT NUMBER 6	
COST ($ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6: Netcentric Systems Test	8.807	12.254	12.477						Continuing	Continuing

A. Mission Description and Budget Item Justification

The Netcentric Systems Test (NST) focus area is pursuing technologies to keep pace with the advancements in Joint Net-Centric Operations (JNO) requirements for Test & Evaluation (T&E). These advanced Netcentric Systems will address the needs of the Joint force and coalition partners who must have rapid access to relevant, accurate, and timely information, and also the ability to create and share the knowledge required to make superior decisions in an assured environment amid unprecedented quantities of operational data. This will enable the JNO to meet the requirement to provide an integrated global network enabling the ability to share the right information at the right time so that Warfighters can act before the enemy acts. JNO links a multitude of people, sensors, operating centers, and decision aids. These sources of information produce relevant, up-to-the second, accurate, and credible information to allow informed decisions in routine, planned, or crisis events. The result – faster decision making, increased collaboration, and better decisions based on access to more information. Successful implementation of these transformational capabilities will necessitate a corresponding transformation in the ability of DoD to test and evaluate netcentric systems. The NST focus area addresses the T&E scenarios, technologies, and analysis tools required to ensure that operational networked systems delivered to the warfighter provide an assured capability to acquire, verify, protect, and assimilate information necessary for battlefield dominance within a complex netcentric environment.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Netcentric Systems Test	8.807	12.254	12.477	
FY 2008 Accomplishments: The NST Focus Area provided numerous briefs throughout the year to socialize and receive critical input from various subject matter experts in the T&E/S&T field. The input received has facilitated further tailoring of the NST focus area to better provide risk mitigation and advanced technologies in support of the Central Test & Evaluation Investment Program (CTEIP) Joint Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Interoperability T&E Capability (InterTEC) project, as well as numerous other potential transition partners. Continued projects initiated in prior fiscal years. - Completed Middleware Enhancements for Netcentric Simulation Architecture (MENSA) efforts to develop and demonstrate a network coding technology that will enable a gain by a factor of two or more in testing middleware communication throughput over test networks.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 6

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Completed Verification for Netcentric Simulations (VNS) effort to develop a quantitative verification methodology for netcentric simulations based on metrics that adequately characterize system performance and effectiveness. - Completed Net Ready Architecture Evaluator (NetRAE), formally Service Oriented Architecture Toolset (SOAT), effort to develop and deliver a toolset to extract critical data from system architecture, and provide compliance to network-ready key performance parameter. - Completed Configurable Situational Awareness Displays (CSAD) effort to develop and demonstrate the creation of a composable 3D visualization tool, capable of centralized control of distributed situational awareness displays for netcentric information operations and communications effects. - Completed Netcentric Systems Test Architecture and Technology Insertion Environment (TIE) effort to develop architecture, tools and a laboratory to integrate, demonstrate and validate NST technology projects. - Continued Dynamic Distributed Networking for Test and Evaluation (DDNTE) effort to develop tools to dynamically configure Netcentric Systems Test infrastructure communications networks. - Continued Joint Virtual Network Centric Warfare (JVNCW) effort to develop the capability to build, test, evaluate, and optimize large-scale, real-time communication networks integrated with hardware, software, external systems, test ranges, and warfighters. - Continued Dynamic Utility for Collaborative Architecture-Centric T&E (DUCAT) (Formerly Technology and Tools For Joint Testing, TTJT) effort to prototype T&E tools for developing test architectures, assigning test measures, and visualizing and testing Joint command and control systems in a service oriented architecture environment. - Continued Executable Architecture Analysis Modeling (EAAM) effort to develop test technologies and create executable models of netcentric architectures comprised of integrated combat, communications and process models. - Continued Technologies for Tactical Video (TTV) and demonstrate a battlespace awareness tool that integrates sensor imagery data with other Joint Mission Effectiveness (JMe) test data projected in distributed network environment. - Continued Analyzer for Netcentric Systems Test Confederations (ANSC) effort to develop and demonstrate web-based technologies to automate Netcentric test planning and scenario development.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 6

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continued Flexible Analysis Services (FAS) effort to develop and demonstrate generic message protocol translation prototypes (initially for Link 16 capability) with a parser rule and profile creation user interface and a generic message parser. Initiated new research efforts to address T&E technology challenges in this focus area. - Joint Mission Environment Support Using Data Farming (JMEDF) (formally Cognitive Capabilities for Data Farming (CCDF)) effort to develop models capturing the C2 structures, Design of Experiment (DOE), Rapid Scenario Generation, and Automated Red Teaming. - Irregular Warfare Effects Mode (IWEM), formally Effects Based Approach to Operations (EBAO), effort to develop modeling technologies for conventional and unconventional effects of Information Operations actions. - Multi-Level Security Cross Layer Scheme (MLSCLS) effort to build multi-level security features into distributed, decentralized, quality of service medium access control while preserving power and bandwidth. - Policy-based Adaptive Network and Security Management Technology for Network Centric Systems Testing (PAM), formerly Policy Based Adaptive Network (PBAN) effort to develop a policy based management system for controlling cross-domain multi-level security and automated network Quality of Service controls through recognition of Test and Training Enabling Architecture (TENA) based applications. - Rapid Reconfiguration Intelligent Module (RRIM) effort to develop a rapid reconfigurable control station prototype to individually or simultaneously control 200 computers to minimize setup time and maximize time for testing. - Service Oriented Architectures (SOA) to Distributed Testing Infrastructure Study effort to assess on-going testing activities using SOA and the technical maturity of those SOA-based testing tools to determine the suitability of SOA-based tools to support distributed testing data management requirements; the benefits of modernizing test instrumentation to use a SOA for distributed testing; and the benefits of modernizing distributed test tools to use a SOA for distributed testing. Initiated a BAA in FY 2008 to select efforts for FY 2009 award.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 6

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
FY 2009 Plans: Continue efforts initiated in prior years. - Complete Executable Architecture Analysis Modeling (EAAM) effort to develop test technologies and create executable models of netcentric architectures comprised of integrated combat, communications and process models. - Complete Dynamic Utility for Collaborative Architecture-Centric T&E (DUCAT) effort to prototype T&E tools for developing test architectures, assigning test measures, visualizing and testing Joint command and control systems in a service oriented architecture environment. - Complete Analyzer for Netcentric Systems Test Confederations (ANSC) effort to develop and demonstrate web-based technologies to automate Netcentric test planning and scenario development. - Complete Joint Virtual Network Centric Warfare (JVNCW) effort to develop the capability to build, test, evaluate, and optimize large-scale, real-time communication networks integrated with hardware, software, external systems, test ranges, and warfighters. - Complete Technologies for Tactical Video (TTV) effort and demonstrate a battlespace awareness tool that integrates sensor imagery data with other Joint Mission Effectiveness (JMe) test data projected in distributed network environment. - Complete Flexible Analysis Services (FAS) effort to develop and demonstrate generic message protocol translation prototypes (initially Link 16 capability) with a parser rule and profile creation user interface and a generic message parser. - Complete Reconfiguration Intelligent Module (RRIM) effort to develop a rapid reconfigurable control station prototype to individually or simultaneously control 200 computers to minimize setup time and maximize time for testing. - Complete Service Oriented Architectures (SOA) to Distributed Testing Infrastructure Study effort to assess on-going testing activities using SOA and the technical maturity of the SOA-based testing tools. - Continue Dynamic Distributed Networking for Test and Evaluation (DDNTE) effort to develop tools to dynamically configure Netcentric Systems Test infrastructure communications networks. - Continue Joint Mission Environment Support Using Data Farming (JMEDF) effort to develop models capturing the C2 structures, Design of Experiment (DOE), Rapid Scenario Generation, and Automated Red Teaming.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 6

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue Irregular Warfare Effects Mode (IWEM) effort to develop modeling technologies for conventional and unconventional effects of Information Operations actions. - Continue Multi-Level Security Cross Layer Scheme (MLSCLS) effort to build multi-level security features into distributed, decentralized, quality of service medium access control while preserving power and bandwidth. - Continue Policy-based Adaptive Network and Security Management Technology for Network Centric Systems Testing (PAM) effort to develop a policy based management system for controlling cross-domain multi-level security and automated network Quality of Service controls through recognition of Test and Training Enabling Architecture (TENA) based applications. Initiate new research efforts to address T&E technology challenges in this focus area. - Middleware Enhancements to Netcentric Simulation Architecture Follow-On (MFP) effort to refine coding techniques to accurately address InterTEC testing requirements. Dynamically optimize information delivery, minimize network congestive failures, and overcome unreliable network environments. - Netcentric Environment Instrumentation and Visualization (NEIV) effort to develop intelligent T&E analytic and visualization tools that will support joint mission effectiveness, net readiness, and joint interoperability evaluation requirements. - Netcentric Systems Test Evaluation Capability Module (NECM) effort to effectively characterize and replicate the Joint Netcentric Operation mission threads, architectures, and measures within the interoperability T&E enterprise. - Test and Training Enabling Architecture (TENA) in a Resource Constrained Environment (TRCE) effort to develop technologies that will recreate the Netcentric Battlespace with increased bandwidth that will support high data rate users with the flexibility to transmit critical information at higher priorities. - Modern Link Manager Protocols (MLMP) effort to develop capability to pass only the required information and the enable the flexibility to deal with unreliable networks. - Net-Ready Key Performance Parameter (NR-KPP) Integrated Architecture (FEND) effort to develop capability to automate testing of the NR-KPP integrated architecture element and visualize the execution of mission threads. Initiate BAA in FY 2009 to select efforts for FY 2010 award.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 6

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
FY 2010 Plans: Continue efforts initiated in prior years. - Complete Dynamic Distributed Networking for Test and Evaluation (DDNTE) effort to develop tools to dynamically configure Netcentric Systems Test infrastructure communications networks. - Complete Joint Mission Environment Support Using Data Farming (JMEDF) effort to develop models capturing the C2 structures, Design of Experiment (DOE), Rapid Scenario Generation, and Automated Red Teaming. - Complete Multi-Level Security Cross Layer Scheme (MLSCLS) effort to build multi-level security features into distributed, decentralized, quality of service medium access control while preserving power and bandwidth. - Complete Net-Ready Key Performance Parameter (NR-KPP) Integrated Architecture (FEND) effort to develop capability to automate testing of the NR-KPP integrated architecture element and visualize the execution of mission threads. - Complete Modern Link Manager Protocols (MLMP) effort to develop capability to pass only the required information and the enable the flexibility to deal with unreliable networks. - Complete Netcentric Systems Test Evaluation Capability Module (NECM) effort to effectively characterize and replicate the Joint Netcentric Operation mission threads, architectures, and measures within the interoperatbility T&E enterprise. - Continue Irregular Warfare Effects Mode (IWEM)effort to develop modeling technologies for conventional and unconventional effects of Information Operations actions. - Continue Middleware Enhancements to Netcentric Simulation Architecture Follow-On (MFP) effort to refine coding techniques to accurately address InterTEC testing requirements. Dynamically optimize information delivery, minimize network congestive failures, and overcome unreliable network environments. - Continue Policy-based Adaptive Network and Security Management Technology for Network Centric Systems Testing (PAM) effort to develop a policy based management system for controlling cross-domain multi-level security and automated network Quality of Service controls through recognition of Test and Training Enabling Architecture (TENA) based applications.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 6

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue Netcentric Environment Instrumentation and Visualization (NEIV) effort to develop intelligent T&E analytic and visualization tools that will support joint mission effectiveness, net readiness, and joint interoperability evaluation requirements. - Continue Test and Training Enabling Architecture (TENA) in a Resource Constrained Environment (TRCE) effort to develop technologies that will recreate the Netcentric Battlespace with increased bandwidth that will support high data rate users with the flexibility to transmit critical information at higher priorities. Initiate BAA in FY 2010 to select efforts for FY 2011 award.				

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					PROJECT NUMBER 7	
COST ($ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
7: Unmanned and Autonomous System Test	3.998	5.465	6.371						Continuing	Continuing

A. Mission Description and Budget Item Justification

The next generation of unmanned warfighting support systems is in development and will rapidly transition from research efforts into acquisition programs. In addition, on-going research into autonomous and semi-autonomous systems indicates such systems will soon emerge as a new test challenge. The Unmanned and Autonomous Systems Test (UAST) focus area addresses current and emerging challenges associated with T&E of these important warfighting assets. As the complexity of Unmanned and Autonomous Systems (UAS) increases, the capability to test these systems must be developed, also. UAS T&E technology advancements are required to enable testing of the behavior of learning unmanned and autonomous systems. Ranges and installed system test facilities must be able to characterize UAS responses to mission priorities in densely-packed battlespaces and predict from the data how these systems will respond in the future. The Department of Defense must have the capability to test the ability of these systems to interact safely and effectively with large groups of humans and to determine how these systems respond to unscripted scenarios. This capability requires the development of technology to collect and compare accurate situational awareness of autonomous systems with ground truth; test unmanned systems in a netcentric environment; maintain non-line-of-sight tracking; and execute controlled, repetitive, and realistic stimulation of systems under test.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Unmanned and Autonomous System Test	3.998	5.465	6.371	
FY 2008 Accomplishments: Continued efforts initiated in prior fiscal years. - Completed Flexible Command and Control project to develop a communications bus that permits operation of multiple UAS platforms within a precisely prescribed environment that can be monitored and controlled locally or widely distributed over the test infrastructure. - Completed Software Configurable Multi-Channel Transceiver project to develop flexible, multiband, command and control communications systems to support data capture during complex multi-agent UAS test scenarios that address the unique test aspects of UAS communications, range safety and vehicle performance. - Continued High Fidelity Communication Modeling and Analysis project to develop M&S tools to provide controlled, repetitive, realistic stimulation of systems under test.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 7

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continued Intelligent Agent Based Framework project to develop software-based preplanning techniques which properly characterize communications links to support UAS operations in complex environments. - Continued Micro-beacon Tracking of Autonomous Systems project to develop TSPI instrumentation by building a tracking station architecture consisting of antennae and signal processing. - Continued Reconfigurable Wireless Measurement System project to develop a three-board wireless sensor stack (consisting of GPS, data acquisition, telemetry, and analog to digital converter components) for both truth and perceived truth data. - Continued Remote Embedded Systems Test project to develop and integrate long duration, lightweight, hybrid power/energy minimization and power switching systems for reliable UAS operation of onboard sensors and data transmission devices. Initiated research efforts to address T&E technology challenges in this focus area. - Cognitive Autonomous Systems-of-Systems Tester project to develop the ability to test collaboration capabilities in multiple agent unmanned and autonomous vehicle settings. - Software and Hardware for Multi-Resolution Maps/Models project to develop multi-level situational awareness models. - Virtual Autonomous Teaming Tool Test Configuration project to predict the changes produced within UAS as a result of modifications to external stimuli. Initiated BAA in FY 2008 to select efforts for FY 2009 award. *FY 2009 Plans:* Continue efforts initiated in prior fiscal years. - Complete Intelligent Agent Based Framework project to develop preplanning techniques which properly characterize communications links to support UAS operations in complex environments. - Complete Remote Embedded Systems Test project to improve power summing by controlling power distribution and improve extensions to increase connectivity with multiple vehicle systems under test. - Complete Micro-beacon Tracking of Autonomous Systems project to develop non-obtrusive TSPI instrumentation by optimizing power consumption.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 7

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue Reconfigurable Wireless Measurement System project to develop non-intrusive test instrumentation for real-time measurement by reducing size to a two-board processor stack consisting of sensors, data storage, and telemetry units. - Continue High Fidelity Communication Modeling and Analysis project to develop M&S tools to provide controlled, repetitive, realistic stimulation of systems under test. - Continue Software and Hardware for Multi-Resolution Maps/Models project to develop analytical software integrating diverse bits of data into standard multilevel situational awareness models. - Continue Cognitive Autonomous Systems-of-Systems Tester project to develop the ability to test collaboration and utilization capabilities in multiple agent unmanned and autonomous vehicle settings. - Continue Virtual Autonomous Teaming Tool Test Configuration project to predict the changes produced within UAS as a result of modifications to external stimuli. Initiate new research efforts to address T&E technology challenges in the focus area. - Develop Prescriptive and Adaptive Framework (PATFrame) to serve as a foundation for a new Unmanned and Autonomous Systems test and evaluation paradigm. Objectives include determine the best in class test strategies available across industry and government through a descriptive framework; and develop a prescriptive framework for improving decision making according to normative and descriptive standards. - Develop Simulated Cooperative Unmanned Underwater Laboratory (SCUUL) to address specific UAST needs including (1) modeling of cooperative Unmanned Undersea Vehicle (UUV) or Unmanned Surface Vehicle (USV) navigation in high currents and surface winds; (2) modeling the impact of communication limitations on cooperative UUV/USV behavior; (3) developing measures of performance and effectiveness for cooperative UUV/USV sampling and (4) operator interfaces to multi-vehicle teams. Investigators will perform applied research in model-based multi-target tracking in support of the design of a micro-UUV Testbed. - Develop methods for testing autonomous space systems (e.g. accessibility, latency, safety/health hazards, etc.) in an operationally relevant environment. - Develop tools to evaluate the cognitive behavior and predict future performance of learning algorithms in semi-autonomous and autonomous systems. Initiate a BAA in FY 2009 to select efforts for FY 2010 award.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 7

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
FY 2010 Plans: Continue efforts initiated in prior fiscal years. - Complete Cognitive Autonomous Systems-of-Systems Tester project to develop ability to test collaboration and utilization capabilities in multiple agent unmanned and autonomous vehicle settings. - Complete High Fidelity Communication Modeling and Analysis project to develop tools to provide controlled, repetitive, and realistic stimulation of systems under test. - Complete Reconfigurable Wireless Measurement System project to develop non-intrusive test instrumentation for real-time measurement and UAS tracking. - Complete Software and Hardware for Multi-Resolution Maps/Models project to develop analytical software integrating diverse bits of data into standard multi-level situational awareness models. - Complete Virtual Autonomous Teaming Tool Test Configuration project to predict the changes produced within UAS as a result of modifications to external stimuli. - Continue Evolutionary Path Planning Algorithm project to develop the ability to test autonomous systems decision making software. - Continue Genetic Cognitive Algorithm Assessments project to evaluate response of stimulated autonomous systems. - Continue Ground Control System Architecture Test Tool project to develop Control System Architecture evaluation tool to aid new unmanned and autonomous system insertion into theater while not negatively intruding upon function of ongoing warfighting efforts. - Continue Simulated Environment System Data Capture project to provide stimulus and track vehicle sensory, perception, and response plan by developing data perception and decision tracking software. Initiate a BAA in FY 2010 to select efforts for FY 2011 award.				

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 7

E. Performance Metrics

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					PROJECT NUMBER 8	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
8: Common Range Integrated Instrumentation System	0.000	15.000	10.000						Continuing	Continuing

A. Mission Description and Budget Item Justification

The Department of Defense has a critical need for enhanced T&E instrumentation to support advanced aircraft, avionics, and weapons system testing. The Common Range Integrated Instrumentation System (CRIIS) is a tri-service project that provides a family of capabilities to improve time-space-position information (TSPI) accuracy in low- to high-dynamic test environments and data link throughput capabilities using spectrally efficient data links. CRIIS participant packages will be highly miniaturized in both pod-mounted and internally mounted configurations. CRIIS is highly dependent upon advanced technology development in the areas of high-accuracy TSPI and spectrally efficient, high throughput data transmission. CRIIS will replace the aging Advanced Ranged Data System (ARDS) developed in the mid-1980s. ARDS suffers from parts obsolescence and will not provide accuracies and data throughput required by advanced weapon systems.

B. Accomplishments/Planned Program ($ in Millions)	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
Common Range Integrated Instrumentation System	0.000	15.000	10.000	
FY 2008 Accomplishments: N/A				
FY 2009 Plans: - Begin Phase 1 risk reduction and technology maturation for high throughput, spectrally efficient data link. - Begin Phase 1 risk reduction and technology maturation for high accuracy TSPI. - Conduct System Requirements Reviews, Interim Baseline Review #1, and System Functional Reviews. - Complete Phase 1 risk reduction and technology maturation for high throughput, spectrally efficient data link. - Complete Phase 1 risk reduction and technology maturation for high accuracy TSPI. - Conduct Interim Baseline Review #2 and successful Preliminary Design Review. - Accomplish field test demonstration and Technology Readiness Assessment. - Down select to a single prime contractor.				

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 8

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
FY 2010 Plans: - Complete Phase 1 risk reduction and technology maturation for high throughput, spectrally efficient data link. - Complete Phase 1 risk reduction and technology maturation for high accuracy TSPI. - Conduct Interim Baseline Review #2 and successful Preliminary Design Review. - Accomplish field test demonstration and Technology Readiness Assessment. - Down select to a single prime contractor.				

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

The CRIIS program acquisition strategy is comprised of a competitive risk reduction phase followed by a down select to accomplish System Design and Demonstration (SDD) and production. A Technology Readiness Assessment conducted in the summer of 2006 revealed key technologies as immature and was the basis of this approach. The Department plans to conduct the risk reduction effort for approximately two years or until one of the contractors has fallen outside the competitive range and further expenditure of funds would not provide value to the government, based on established criteria. The Department will issue the final RFP for down select 90 days before the possible down select point calling for proposal not later than 60 days before the down select point. The complete details for the down select criteria are currently in development.

E. Performance Metrics

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology					PROJECT NUMBER 9	
COST ($ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
9: Multi-Level Security	0.000	0.000	0.000						Continuing	Continuing

A. Mission Description and Budget Item Justification

Multilevel security (MLS) has posed a challenge to the computer security community since the 1960s. MLS will allow information to flow freely between recipients in a computing system who have appropriate security clearances while preventing leaks to unauthorized recipients. MLS systems must incorporate two essential features: first, the system must enforce these restrictions regardless of the actions of system users or administrators, and second, MLS systems must enforce these restrictions with incredibly high reliability. This has led developers to implement specialized security mechanisms and to apply sophisticated techniques to review, analyze, and test those mechanisms for correct and reliable behavior.

Despite this, MLS systems have rarely provided the degree of security desired by their most demanding customers in the military services, intelligence organizations, and T&E activities. Incorporating MLS into telemetry for T&E would allow all users of the data to have access to the same data stream and computer network according to their security clearance level and need-to-know. This would significantly increase efficiency and generate cost savings. MLS will also allow more streamlined testing with coalition partners.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Multi-Level Security	0.000	0.000	0.000	
FY 2008 Accomplishments: N/A				
FY 2009 Plans: N/A				
FY 2010 Plans: N/A				

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2a, PB 2010 Office of Secretary Of Defense RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603941D8Z Test and Evaluation/Science and Technology	PROJECT NUMBER 9

E. Performance Metrics

N/A